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ABSTRACT

Although many public schools are nominally desegregated, the interaction among students of varying racial and ethnic backgrounds is minimal. Desegregated schools need to restructure the classroom in order to create more positive and constructive relationships among students from varying backgrounds. The present study investigated the restructuring of seventh grade mathematics classes by means of student teams and instructional games. The study examined how this restructuring affected cross-race and cross-sex selection by students of their helpmates and friends. The subjects were 115 seventh grade students at a large urban junior high school; 43 percent of the students were blacks, and 47 percent were males. A two by two randomized design was used manipulating Task and Reward. Placing students on heterogeneous four-member student teams created significantly greater cross-race and cross-sex helping and friendship. Playing the instructional game had a marginal effect on cross-race helping only; however, the game-team combination increased considerably the incidence of cross-race and cross-sex interaction over that of games alone. (Author/JM)

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STUDENT TEAMS AND INSTRUCTIONAL GAMES: THEIR EFFECTS ON CROSS-RACE AND CROSS-SEX INTERACTION

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INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games program has developed simulation games for use in the classroom. It is evaluating the effects of games on student learning and studying how games can improve interpersonal relations in the schools. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Talents and Competencies program is studying the effects of educational experience on a wide range of human talents, competencies, and personal dispositions in order to formulate -- and research -- important educational goals other than traditional academic achievement. The School Organization program is currently concerned with the effects of student participation in social and educational decision-making, the structure of competition and cooperation, formal reward systems, effects of school quality, and the development of information systems for secondary schools. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report was a cooperative project of the Academic Games and the School Organization programs. The study investigates two teaching techniques -- student teams and instructional games -- to evaluate their effects on cross-race and cross-sex interaction of students.

ABSTRACT

Although many public schools are nominally desegregated, the interaction among students of varying racial and ethnic backgrounds is minimal. The present study evaluated the effects of two teaching techniques -- student teams and instructional games -- on the level of cross-race and cross-sex interaction in the classroom. Placing students on heterogeneous four-member student teams created significantly greater cross-race and cross-sex helping and friendship. Playing the instructional game had a marginal effect on cross-race helping only; however, the game-team combination increased considerably the incidence of cross-race and cross-sex interaction over that of games alone. Katz's theory of biracial work groups is evaluated in light of the present results.

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INTRODUCTION

Even as many school systems are desegregating by altering the racial composition of their schools, social integration of minority groups remains minimal. Integrated education demands far more than changing the racial composition of schools and classrooms; it demands establishing working relationships and understanding among the students and between teachers and students (Wagoner, Glatt & Gaines, 1970; Georgeoff, Jones, Bahlke & Howard, 1970; Winnecoff & Kelly, 1971). Desegregated schools need to restructure the classroom in order to create more positive and constructive relationships among students from varying backgrounds. The present study investigated the restructuring of seventh grade mathematics classes by means of student teams and instructional games. The study examined how this restructuring affected cross-race and cross-sex selection by students of their helpmates and friends.

There is considerable evidence that barriers to racial interaction exist among students in desegregated schools. Mann (1959), Webster (1960), St. John (1964), Gottlieb (1965), and Coleman, et al. (1966) found considerable within-race preference for both classmates and friends by both black and white students. Such within-race preference has been substantiated for students from the sixth grade up through college. As noted by both McPartland (1968) and Pettigrew (1968), the racial barriers are stronger for the more intimate relationships, such as friendship, than for formal task relationships.

Although there are no similar data concerning the existence of

social barriers between the sexes for students in middle and secondary schools, casual observation of the informal interaction among seventh grade students (the grade included in the present study) quickly suggests that these students do not communicate -- either in or out of the classroom -- with students of the opposite sex.

The use of student teams has frequently been suggested as a way to create greater interracial cooperation and acceptance (cf. Allport, 1954, Gottlieb, 1965, Thelen, 1970). The studies of interracial work groups have produced mixed results. In a study of four-member biracial work teams, Katz, Goldston, and Benjamin (1958) found no increase in interracial communication among team members (individuals rewarded at the group level) as compared to individuals who worked in a group situation but who were rewarded individually. Katz and Benjamin (1960) and Cohen (1969), created modified replications of the Katz, et al. (1958) study with essentially the same results.

Witte (1972) created biracial work teams in a college classroom and observed their effects on interracial acceptance. Working on individual tasks, the teams were rewarded on the total performance of the group. The students worked in teams for a semester. The teams created more interracial peer tutoring, more racial acceptance (measured by several racial attitude scales), and less racial isolation (as measured by a seating aggregation index). The success of Witte's teams may be explained in part by their meeting the several prerequisites suggested by Allport (1954) for effective interracial contact. The teams created a common goal among the students on a team by making them cooperatively dependent upon each other. The students were

assigned equal-status roles, and the teacher reinforced racial interaction.

The contradiction in the results of the Katz studies as compared to those of Witte (1972) may be explained in part by the nature of the work teams used. Katz created ad hoc groups that worked together for only a short time. Witte used more intact, natural groups and gave the groups enough time to coalesce. Because the present study uses groups similar to those of Witte, and groups which meet most of Allport's conditions for effective racial interaction, we predict increased cross-race and cross-sex interaction when students are placed on biracial work teams.

No studies have dealt with the effects of playing games on cross-race and cross-sex interaction and acceptance, but a number of empirical studies (cf. Boocock & Schild, 1968) reveal a positive effect of game playing on student attitudes and academic achievement. However, playing a learning game places students of different races and/or sexes in face-to-face competition, and both Allport's model (1954) and the studies by Katz (1970) suggest that interracial contact in competitive settings may be aversive to the individuals. Therefore, the predicted effect of games on cross-race and cross-sex interaction is positive, but less than the predicted effect of teams because of the competitive nature of the interaction in a game setting.

METHOD

Subjects

The subjects were 115 seventh grade students at a large urban junior high school; 43% of the students were blacks, and 47% were males. Students were randomly assigned to one of four first-period mathematics classes on a stratified basis; the stratification was based upon three levels of math ability to insure an equal distribution across the four classes. There was no significant nonrandom clustering by race or sex of students across the treatment conditions. The racial distributions in the four classes ranged from 38 to 52% blacks ($X^2 = 1.24$; df = 1; $p < .50$). The division by sex ranged from 41 to 50% males ($X^2 = .22$, df = 1; $p < .75$).

Design

A 2 x 2 randomized design was used manipulating (a) Task (games vs. quizzes), and (b) Reward (team vs. individual). The experiment was conducted over a four-week period, involving twenty school days.

Two male and two female teachers participated in the study, all of whom were in their first or second year of teaching. One of the four teachers was black, the remaining three were white. The teachers were rotated at the midpoint of the study, so that each treatment was taught by both a female and male teacher. Because the teacher factor was still partially confounded with treatment, more frequent teacher rotation was considered but rejected because of the real possibility of extensive disruption of classwork.

Independent Variables

Two types of math tasks were created: an instructional game and standard math quizzes. The instructional game was Equations, developed by Allen (1969). The game taps both arithmetic and general logic skills. When playing Equations the objective is to beat the other players by superior use of mulitple mathematical solutions to a pre-assigned numerical "goal." Within a classroom of thirty students, ten Equations games were played simultaneously (three students per game). The players at any given table were grouped homogeneously on math ability. At the end of each game, each individual player was assigned a score, and at the end of the period, his game scores were summed to form a total day score. Depending on whether a student won or lost, he was moved up to a higher ability table or down to a lower ability table. This "bumping" procedure maintained homogeneous game tables while taking into account new learning (as reflected in a student winning or losing).

The second level of the task variable consisted of biweekly teacher-made math quizzes on material covered during the preceding days. For each quiz the students were assigned a percentage score based on the number of problems solved correctly.

The weekly schedule of all treatment groups proceeded as follows: students in the two games classes played Equations for one-half period each Tuesday and for the entire period on Friday. The math quizzes were administered to the two nongame classes for part of the period on each Tuesday, and Friday. The remainder of the week involved traditional instruction (two and a half days for game

and three days for nongame classes) and practice sessions (total of one day per week for all classes).

Two types of reward structure were created: one administered rewards to four-member teams and the other rewarded individuals. In the two classes using teams, students were assigned to four-member groups with the specific intention of creating maximal intrateam heterogeneity (on race, sex, and ability) while maintaining interteam equality. Teammates were encouraged to help each other during the practice periods. However, each team member performed individually in both the game and quiz classes. On the day after the game or quiz a newsletter was given to the students in the teams treatment. The newsletter listed the preceding day's scores for the individual students as well as for the entire team.[1] A cumulative score for each student and each team was also listed. The teams were ranked by both the preceding day's team scores and the cumulative scores (or season record). The team students were periodically reminded that their math grade was partially contingent on their team's score. Nevertheless, the public feedback in the newsletter appeared to be the major reward. In the two classes using individual rewards, the newsletter listed the scores of individual students. Both cumulative scores and those of the preceding day were listed. The individual reward students were told their math grade would depend in part on their own performance on the quizzes or games.

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[1] The team score was obtained by summing the scores of all members present for the game or test. Teams with absent members were thus penalized, with no provision for make-ups.

Dependent Variables

In order to assess the level and direction of informal helping and friendship patterns in the four treatment conditions, three sociometric items were included in a student questionnaire. The students were asked to give the names of fellow classmates (1) "whom you helped"; (2) "who helped you"; and (3) "who are your friends." Eight blank lines were allotted for responses to each of the three questions. Two helping items -- instead of only one -- were included in order to assess the level of reciprocity in the helping estimates. Such an assessment would be useful to determine the reliability of the student descriptions of interpersonal relationships in the classroom. Of interest in the present study is the number of cross-race and cross-sex selections (over all selections) on both the helping and friendship dimensions for each of the four treatment conditions. The sociometric data were collected on the final day of the experiment.

RESULTS

Inter-Student Agreement

Of the friendship choices made by all participants in the study, a majority (61%) were mutual. The overlap for the you helped-helped you items revealed 46% agreement. The slight reduction in inter-student agreement on the helping relationship (as compared to friendship) is due primarily to less agreement within the games classes. Students in the nongames classes agree about helping relationships almost twice as often (62%) as those in the games classes (33%); the difference is

significant (X^2 = 28.09; df = 1; $p < .001$). The nature of the student interaction in the Equations game may have made it difficult for the students to assess the patterns of helping behavior.

Tables 1 and 2

Cross-Race Interaction

The dependent variables of interest are the percentage of cross-race helping, being helped, and friendships. Table 1 contains the percentage of cross-race helping and friendships for each of the four treatment groups. The level of cross-race selection for the control class (the first row of numbers) shows the amount of interracial interaction in a traditional class. The table indicates 33% cross-racial selection for "you helped," 20% for "helped you," and 31% for friends. The data indicate definite preference by students in a traditional class for friends and helpmates from the same race.

The significance of the task, reward, and interaction effects were examined statistically using an analysis of variance technique for qualitative data reported by Goodman (1970).[1]

Table 2 contains the significance tests of the effects of task,

[1]The analysis begins by calculating the natural logarithms of the observed cell frequencies of Table 1. In the analysis, the qualitative dependent variable (helping or friendship choices) is treated as an additional factor in the ANOVA model with the number of levels of the factor equal to the number of categories in the dependent variable. In the present study the number was two: Cross-and within-race or sex. The resulting design, a 2 x 2 x 2, has one observation per cell - the log of the observed frequency. The development of the statistical model (Goodman, 1970) and the method for significance testing (Goodman, 1969) are reported elsewhere.

Table 1

The Percent of Cross-Race Selections
for the Four Treatment Conditions

TREATMENT		YOU HELPED	HELPED YOU	FRIENDS
NO TEAMS	NO GAMES	33% (15)	20% (20)	31% (131)
	GAMES	20% (30)	29% (49)	27% (108)
TEAMS	NO GAMES	38% (60)	34% (61)	37% (159)
	GAMES	44% (52)	54% (56)	34% (147)

Note: ( ) = Total number of student selections.

Table 2

Z Ratios for Test of Main and Interactive
Effects on Percent Cross-Race Choices

SOURCE	YOU HELPED	HELPED YOU	FRIENDS
TASK	-.556	1.684**	-.940
REWARD	1.698**	2.413***	1.601*
TASK x REWARD	1.159	.425	.217

*p < .10
**p < .05
***p < .01

reward and the task-by-reward interaction on the cross-race helping and friendship patterns. The table reveals a significant positive task effect ($Z = 1.684$, $p < .05$) for the "helped you" variable, but not for the "you helped" or friendship variables. Games resulted in a greater amount of cross-race helping. The reward factor showed a significant effect for the two helping behavior measures ($Z = 1.698$; $p < .05$: $Z = 2.413$; $p < .01$) and showed a marginally significant ($p < .10$) effect for cross-racial friendship. The teams condition resulted in a greater amount of cross-race choices on both helping and friendship dimensions. No significant task x reward interactions were noted.

Cross-Sex Interaction

Tables 3 and 4

Table 3 contains the percent of cross-sex selections for the four treatment conditions. The traditional class (no teams-no games) is characterized by a very low level of cross-sex interaction: 13% for "you helped," 10% for "helped you," and 21% for "friends." In this particular seventh grade class, sex appeared to be a more formidable natural barrier to interaction than race. Goodman's ANOVA for qualitative data was also used in the analysis of the cross-sex data. The resulting tests of significance are listed in Table 4. The table reveals no significant task main effects for the helping dimensions, and a marginally significant ($Z = -1.522$; p .10), negative effect on the friendship dimension. The games caused a slight retreat back into

one's own sex group for selection of friends. The reward factor had a significant and positive effect on all three sociometric choice dimensions (Helping: $Z = 2.607$, $p < .01$; $Z = 3.094$, $p < .01$, Friendship: $Z = 2.875$, $p < .01$). A significant task x reward interaction was observed for the "helped you" variable only ($Z = 2.292$, $p < .05$). Figure 1 shows the interaction in greater detail. It appears that adding games to the curriculum had a positive effect on the level of cross-sex helping for the No Teams condition and a slight negative effect on the Teams condition.

Figure 1

Summary of Results

Table 5

Table 5 summarizes the main results of the study. The table suggests that teams created widescale cross-race and cross-sex student interaction across all three behavioral dimensions. The instructional game, particularly when used without student teams, had a much less pronounced effect than did teams. What effect the game did have varied for the race and sex dimensions; creating slightly less cross-sex selection of friends, and greater cross-race selection of students who "helped you."

Table 3

The Percent of Cross-Sex Selections
for the Four Treatment Conditions

TREATMENT		YOU HELPED	HELPED YOU	FRIENDS
NO TEAMS	NO GAMES	13% (15)	10% (20)	21% (131)
	GAMES	27% (30)	33% (49)	17% (108)
TEAMS	NO GAMES	43% (60)	49% (61)	33% (159)
	GAMES	46% (52)	41% (56)	27% (147)

Note: ( ) = Total number of student selections.

Table 4

Z Ratios for Test of Main and Interactive
Effects on Percent Cross-Sex Choices

SOURCE	YOU HELPED	HELPED YOU	FRIENDS
TASK	1.032	.968	-1.522*
REWARD	2.607***	3.094***	2.875***
TASK x REWARD	-.790	-2.292**	-.049

*p < .10
**p < .05
***p < .01

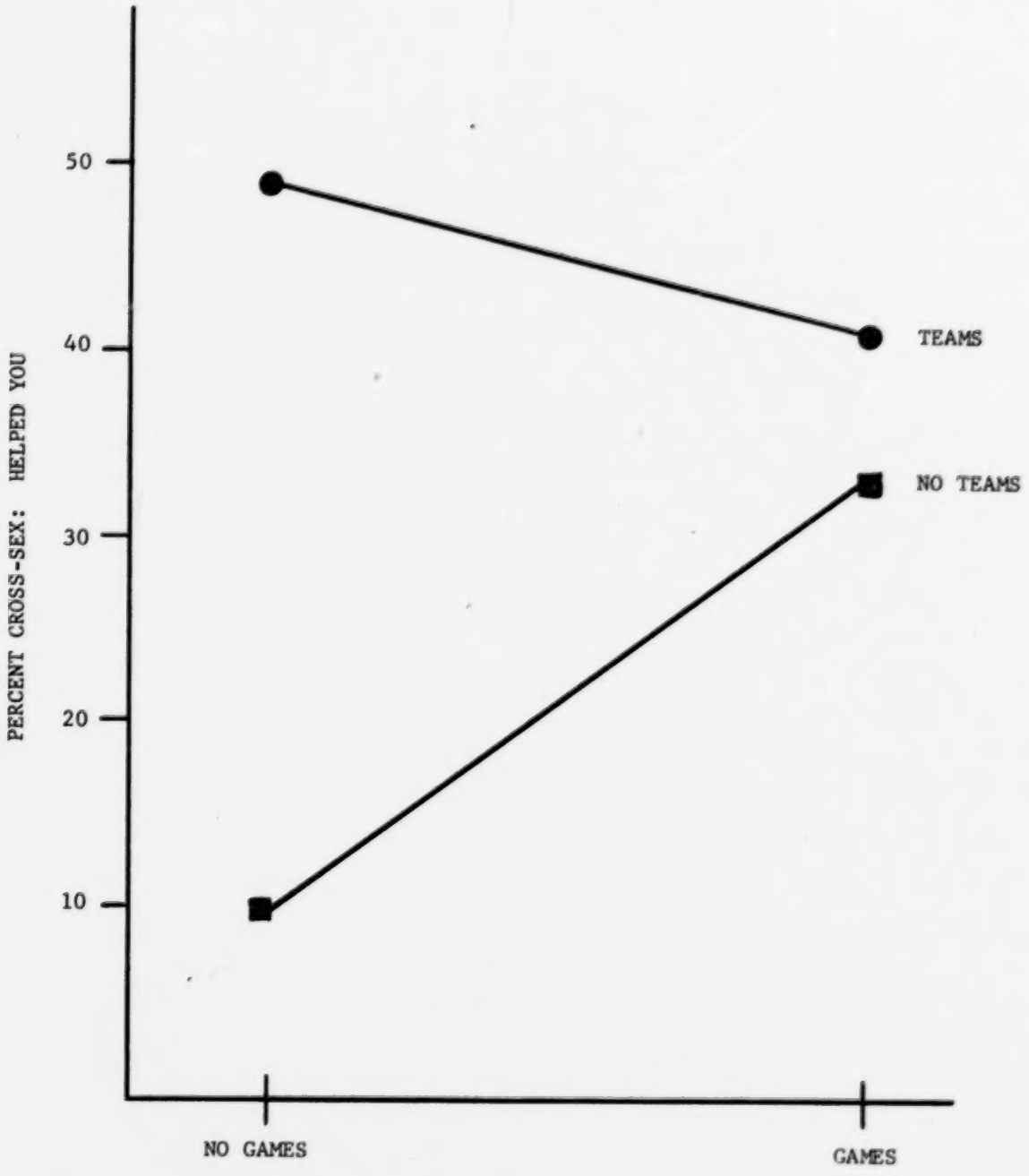

Figure 1. The Teams-by-Games Interaction for Cross-Sex Selections

Table 5

Summary of Teams and of Games Main Effects

BEHAVIORAL DIMENSION	DIFFERENCE IN CROSS LISTINGS			
	Race		Sex	
	Teams vs No Teams	Games vs No Games	Teams vs No Teams	Games vs No Games
YOU HELPED	increase $p < .05$	---	increase $p < .01$	---
HELPED YOU	increase $p < .01$	increase $p < .05$	increase $p < .01$	---
FRIENDS	increase $p < .10$	---	increase $p < .01$	decrease $p < .10$

DISCUSSION

The results clearly indicate that using student teams in the classroom helps reduce race and sex barriers to student interaction.[1] The results support those obtained by Mann (1959) and Witte (1972) in their studies of student teams. The contention of Katz (1970) that placing students in interracial work groups may create interracial hostility is not supported. The team students selected proportionately more students from a different race or the opposite sex as helpmates and as friends. For the seventh graders in the study, friendship patterns appeared to be significantly influenced by their on-task interaction in the student teams.

The success of the teams in reducing the barriers to social integration is likely due to the following two factors. First, rewarding at the group rather than the individual level creates an interdependence among team members that "demands" interaction among teammates whether they want it or not. It is to the advantage of a high ability student to help his teammates, regardless of what he may think of them. In particular, if he does not help the low ability students, they will detract from the performance of the team relative to the other teams in the classroom. Second, the teams were effective in reducing barriers because of a genuine mutual concern shown by the students for

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[1] It should be noted that tracking of students in a school, i.e. assigning students to different courses or classes by ability, may preclude the possibility of cross-race or at least cross-social class integration. The junior high school in the present study as a matter of policy grouped heterogeneously. In homogeneously grouped classes the overall effects of student teams may be reduced considerably.

their teammates. Other studies of student teams (DeVries, Muse & Wells, 1971; DeVries & Edwards, in press) indicate a positive concern by students for the welfare of their teammates. Because of such positive mutual concern it is not surprising that the cross-sex, and to a smaller degree, cross-race helping relationships generalized to friendships.

The overall inability of the instructional game, Equations, to reduce race and sex barriers to interaction is probably due to the student competition created by the game. Although students in the Equations classes are more likely to interact with members of the opposite sex and different races, they do so in the context of meeting an "opponent." The outcome of such an encounter is always a ranking of the individuals on some status dimension. Students playing the game are not likely to go out of their way to assist their fellow players (their opponents). Additionally, the games-only treatment involves small groups whose membership constantly changes. If a student wanted to initiate a friendship with another, the two would soon be separated because each day they had different opponents. In short, because Equations (without teams) creates competition among students and because the composition of the daily groups changes, it fails to dissolve race and sex barriers in the classroom. However, when teams are added to the game structure (as advocated by its designer, Layman Allen), the combination facilitates both cross-race and cross-sex interaction.

We should note that data on biracial work groups have typically been analyzed separately for the white subjects and black subjects.

This is because biracial work groups have been viewed (Katz, 1970) as combining a high status group (whites) with a low status group (blacks). Given this theory of biracial groups one would predict different reactions for whites and blacks to the group situation. For example, whites, as the dominant, high status group might be threatened by the inclusion of blacks into their groups and consequently select even more friends and helpmates from the same race. As the low status group seeking entry into the high status group, blacks might be expected to select a large number of whites. This trend would be particularly present on the more intimate, social dimensions, such as friendship.

A brief examination of the friendship cross-race selections for the blacks and whites across the four treatment groups suggests that the status hypothesis is not supported (Control: blacks = 28%, whites = 35%; Games only: blacks = 62%, whites = 15%; Teams-only: blacks = 44%, whites = 30%; Games-Teams: blacks = 38%, whites = 37%).[1] For three of the four conditions the two racial groups had fairly comparable proportions of cross-racial selection of friends. Only for the games-only treatment was there a large discrepancy, with the black students selecting a large percentage of white students (62%), and the white students selecting very few black students (15%). It should be noted that the Equations tournament structure creates a distinct status hierarchy by the numbering of tables, ranging from ten (low ability) to one (high ability). A breakdown by race of the players

[1]The patterns for the two helping relationship measures were similar to the friendship variable, and, consequently, are not given.

at the top five, as compared to the bottom five tables for the games-only treatment indicated that about twice as many black students played at the bottom five tables as did at the top five. Since the black students played more at the less prestigious tables, status differentiation was likely to form along racial lines. When teams are added to games, the status differentiation along racial lines is eliminated (as evidenced by the equal percentage of cross-race selections by whites and blacks in the games-teams group). Except for the games-only treatment, the biracial interaction was not one of a low status group trying desperately to gain entry into a high status group (as predicted by Katz, 1970), but rather of two equal status groups mutually sharing needed resources.

Student teams represent a classroom technique readily accessible to teachers across grade levels and subject matter. Recent studies of student teams (Wodarski, et al., 1971; Hamblin, et al., 1971; Witte, 1972; DeVries & Edwards, in press) suggest that teams create high levels of student peer-tutoring and, in turn, increase general academic achievement. This study, in addition, suggests such tutoring can take place between students of different races and of opposite sexes, thus contributing to the academic achievement of the students involved and advancing the integration process in desegregated schools.

The present study leaves unanswered many questions concerning the nature and extent of the effects of teams on social integration of minority groups in the classroom. Perhaps the most obvious is the longstanding question of whether increased interracial contact leads to more positive interracial attitudes. Unfortunately, no data on

racial attitudes could be collected in the present study. The increased racial interaction noted for the teams conditions existed not only for more formal task-related dimensions (helping) but also (to a lesser degree) for more intimate social dimensions (friendships). Such transfer suggests increased interracial acceptance. Nevertheless, we need to assess more directly the effects of teams on attitudes toward different races and toward the opposite sex.

Also of interest is determining the long-range effects of teams on the social integration of a classroom. Upon completion of the study, did the students return to selecting within-race and within-sex classmates as helpmates and friends? Or was there a cumulative treatment effect, with students seeking even more cross-race and cross-sex friends and helpmates? A final question left unanswered concerns the nature of the interaction between the sexes and across the races. What was the affective tone of the interaction? Was there a development toward greater acceptance as the treatment period progressed? Answers to these and other questions require more research using more diverse measures of social integration.

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